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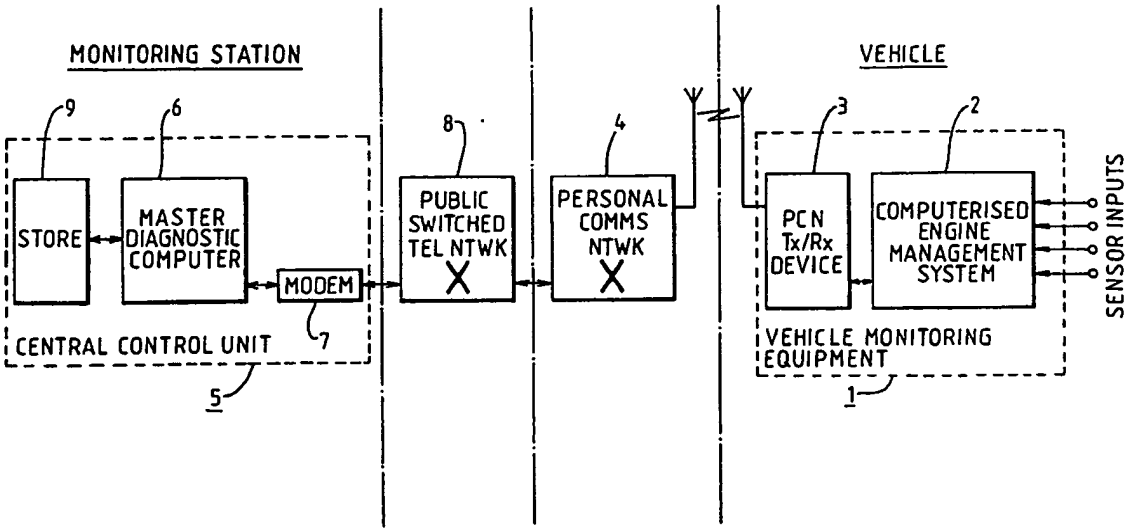
(54) Vehicle monitoring equipment

(57) Vehicle borne monitoring equipment (1) comprises assessment means (2), such as a computerised engine management system, for providing data concerning a preselected operational parameter of the vehicle, and data transmission means (3), such as a PCN transceiver, connected to the assessment means for transmitting such data over a radio link to data reception means (4) remote from the vehicle, e.g. at a maintenance centre.



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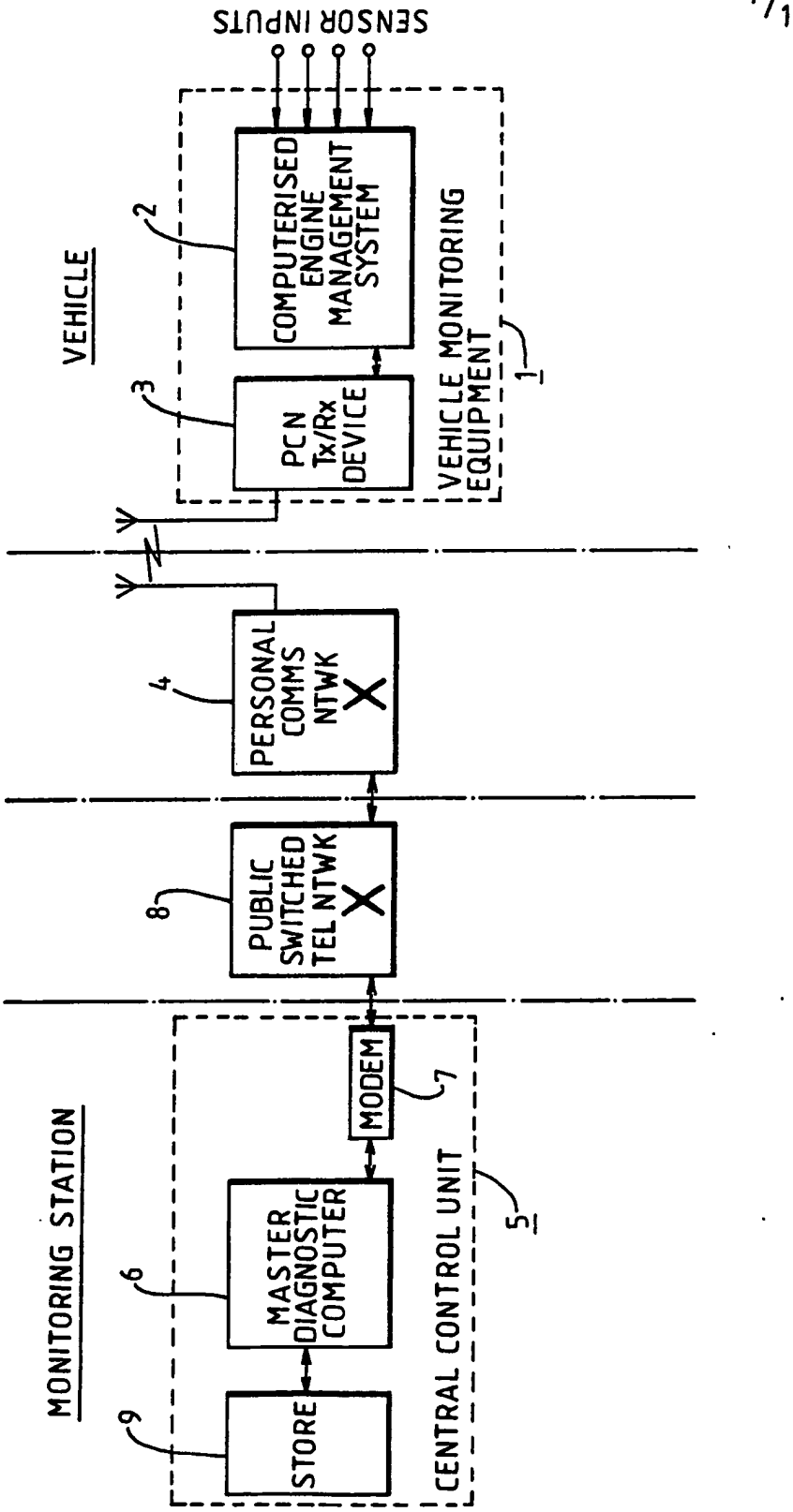
At least one drawing originally filed was informal and the print reproduced here is taken from a later filed formal copy.


SENSOR INPUTS
VEHICLE
COMPUTERISED ENGINE MANAGEMENT SYSTEM
2
PCN Tx/Rx DEVICE
3
VEHICLE MONITORING EQUIPMENT
1
PERSONAL COMMS NTWK
4
PUBLIC SWITCHED TEL NTWK
8
MODEM
7
MASTER DIAGNOSTIC COMPUTER
6
STORE
9
CENTRAL CONTROL UNIT
5
MONITORING STATION

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VEHICLE MONITORING EQUIPMENT

The present invention relates to vehicle monitoring equipment.

Luxury cars are commonly fitted with computerised engine management systems (EMS) which comprise monitoring units mounted in the car that are operable to monitor the performance of the car's engine and other aspects of the car's functioning. Such units commonly store data relating to the car's functioning for subsequent retrieval by a computer at a maintenance centre, so that during periodic servicing of the car such data can be used to assist in identifying any malfunction of the car.

Such a system can afford worthwhile advantages, particularly in terms of the detection of intermittent faults that might not otherwise be found during routine servicing. However, the system has a number of drawbacks, as follows.

Although the monitoring unit in the car may detect a serious, or potentially serious, malfunction of the vehicle, such malfunction cannot be immediately and reliably communicated to the maintenance centre. Some units are operable to alert the driver to the existence of the most serious types of malfunction (for example by illuminating a hazard warning light on the dashboard) but there is no guarantee even then that the user will respond by promptly notifying the maintenance centre of the problem. Other less serious malfunctions are not normally alerted to the driver, but it is often preferable to treat such initially minor malfunctions at an early stage, before they develop into major faults that are expensive to rectify or possibly even potentially dangerous.

More importantly, even if the driver does become aware of a fault and notifies the maintenance centre accordingly, usually he will not have th expertise to access the operational data held by the monitoring unit,

which data will often hold the key to identifying the nature of the malfunction and to determining whether it is sufficiently serious to warrant immediately taking the car to the maintenance centre or even, in extreme cases, ceasing use of the vehicle immediately. Even if the driver were capable of accessing the data, he would be unable to interpret it usefully, and the sheer mass of data would be impractical to report verbatim to the maintenance centre by telephone for example.

The inability of the maintenance centre to access the stored operational data held by the monitoring unit promptly has a further significant disadvantage in that it can increase the "down-time" of the vehicle, i.e. the period during which the vehicle is not available for use. Because the maintenance centre must wait until the car is brought in by its owner to access the stored operational data, it will often not be possible to diagnose the fault for some time, and even when the data is available in some cases it may be that repair of the fault requires a new part, or the presence in the centre of a particular specialist repairer, and that the part is presently out of stock and hence must be ordered, or that the specialist is not immediately available. Thus, delays in rectifying the fault may be introduced, increasing the vehicle down-time.

Lastly, the inability to access the operational data instantaneously prevents real-time diagnostics from being performed, as is often desired to verify during, or even after servicing, that a particular malfunction has indeed been rectified. If, for example, the driver or the monitoring unit has identified a fault that is only apparent when travelling at high speeds uphill, often the only way to verify the fault has been rectified (or to obtain further information about the fault) is to drive the car under such conditions. With present engine management systems although performance data can be collected under such conditions, the inevitable delay in

having access to such data can render the rectification of faults only apparent under such conditions difficult and time consuming.

According to a first aspect of the present invention there is provided vehicle monitoring equipment, adapted to be carried by a vehicle to be monitored, which equipment comprises assessment means operable to provide data concerning a preselected operational parameter of the vehicle, and data transmission means connected to the said assessment means for receiving such data therefrom and operable to transmit such data over a radio link to data reception means remote from the said vehicle. According to a second aspect of the present invention there is provided a vehicle monitoring system including such vehicle monitoring equipment and a monitoring station comprising a central control unit having data processing means, connected with the said data reception means, for receiving therefrom such data transmitted by the said vehicle monitoring equipment and operable on the basis of the received data to provide to a user of the system an indication of the functioning of the vehicle.

Such a system can permit the operational data collected by the vehicle monitoring equipment to be accessed, by way of the radio link, by the central control unit at the monitoring station (maintenance centre) when the car is in normal use, rather than only during servicing, thereby facilitating earlier detection of vehicle faults.

In a preferred embodiment the said central control unit further comprises data storage means connected with the said data processing means for storing a data item indicative of the vehicle's functioning on one occasion, the said data processing means being operable on a subsequent occasion to recall that stored data item from the storage means and to compare that item with a corresponding new data item indicative of th vehicle's latest functioning, whereby, on the basis of differences

between the stored and new data items, malfunction of the vehicle can be detected.

In such an embodiment, a vehicle operational parameter which is found to have changed by more than a specified limit between the two occasions is regarded as indicative of a forthcoming failure of the vehicle component or components to which it relates. The specified limits could, for example, be recommended by manufacturers of the components concerned. Furthermore, since the operational data collected by the vehicle monitoring equipment will normally include vehicle odometer readings, the specified limit can be varied in accordance with the difference between the respective odometer readings on the two occasions.

The storage of operational parameters in the monitoring station can also assist in providing a computerised vehicle log for inspection by a prospective new owner of the vehicle, and could be used by manufacturers of vehicle components to investigate the reliability and expected lifetimes of their products.

In a further preferred embodiment the said data transmission means include a transmit/receive device of a mobile telephone network, which network provides the said data reception means. Many luxury cars are already fitted with such cellular transmit/receive devices suitable for use in transmitting the operational data to the central control unit. Furthermore, the use of a mobile telephone network can permit a number of vehicles, each having such a monitoring unit and cellular transmit/receive device, to be monitored by a single central control unit. This will permit cost-effective sharing of facilities between vehicle users subscribing to the system.

Since the mobile telephone network will normally be interconnected with th public switched telephone network, the central control unit can conveniently b connected, by way of a modem, to a subscriber line of th

public switched telephone network.

Pref rably, the mobile telephone network is a personal communications network (PCN). Such a network can provide compact transmit/receive devices and high quality (digital) data transmission.

In another preferred embodiment the said central control unit is operable to transmit an interrogation signal to the said vehicle monitoring equipment so as to cause that equipment to transmit its data to the central control unit. In such an embodiment the central control unit can periodically access the data collected by the vehicle's monitoring equipment by sending thereto the interrogation signal. In a system having a number of subscribing vehicles each carrying monitoring equipment, the central control unit can transmit such an interrogation signal to each subscribing vehicle in a predetermined sequence. The interval between successive accesses can be selected by the user (for example, different intervals could be available, corresponding respectively to different levels of service attracting different tariffs) or can be determined by the central control unit in dependence on such factors as the vehicle's age, usage or expected reliability. The monitoring equipment can, of course, still be operable to transmit operational data to the control unit without having received the interrogation signal, for example if the monitoring equipment detects that the operational data is consistent with a potentially serious malfunction of the vehicle.

The said data processing means may advantageously be connected to a stock control system for providing thereto, on the basis of such data received from the vehicle monitoring equipment, information identifying parts necessary for repair/maintenance of the vehicle concerned. This can help to minimise delays in the availability of parts needed for s rvicing the vehicle and can benefit maintenance departments by allowing

effici nt forward planning for servicing work. Reduction in stocking levels can also realise worthwhile economic advantages.

The assessment means can advantageously include a computerised engine management system (EMS) as already provided on certain makes of luxury car.

Reference will now be made, by way of example, to the accompanying drawing, which shows a schematic block diagram of a vehicle monitoring system embodying the present invention.

The system shown in the drawing includes vehicle monitoring equipment 1 mounted, for example, in the engine compartment of a vehicle. The equipment 1 includes a computerised engine management system (EMS) 2, having a plurality of sensing inputs connected to receive signals provided by sensors disposed at various points within the vehicle to monitor preselected operational parameters of the engine and other components of the vehicle. Thus, the EMS 2 collects data concerning such aspects of the vehicle's functioning as valve wear, ignition timing, fuel/air mixtures, mileage, and brake wear. The EMS 2 typically, but not essentially, includes a storage device capable of storing such data collected over a predetermined period of time. The equipment 1 further includes a transmit/receive device 3 of a mobile telephone network 4, preferably a transceiver of a personal communications network (PCN). The device 3 has a data input port which is connected to an output port of the EMS 2.

At a monitoring station, a central control unit 5 includes a master diagnostics computer 6 connected via a modem 7 to a subscriber line of the public switched telephone network 8. This network 8 is interconnected to the mobile telephone network 4.

The central control unit 5 furth r includes a storag device 9 connected to the mast r diagnostics comput r 6.

When the system is in use the public switched telephone network 8 and mobile telephone network 4 are employed to provide a two-way communications link between the vehicle monitoring equipment 1 and the central control unit 5, irrespective of the location of the vehicle. Thus, operational data collected by the EMS 2 can be transmitted to the master diagnostics computer 6 and the master diagnostics computer can send commands to the EMS 2. Commonly, there will be a number of subscribing vehicles in the system, and each vehicle will have its own EMS and transmit/receive device capable of communicating the vehicle's operational data to the (single) central control unit 5. Each such transmit/receive device has its own unique identifying number (i.e. telephone number) so that the master diagnostics computer can, by causing the modem 7 to dial a chosen telephone number, communicate selectively with any one of the subscribing vehicles.

In one example of the operation of the system, the master diagnostics computer 6 is programmed to initially cause the modem 7 to dial the telephone number of the transmit/receive device 3 of the first subscribing vehicle in the system. After a predetermined handshaking routine has been successfully completed to establish the communications link between the computer 6 and the EMS 2 the computer 6 sends a predetermined interrogation signal to the EMS 2 of the first vehicle to command it to transmit its collected operational data to the computer 6. The computer 6 then compares the data received from the EMS 2 of the first vehicle with data for that vehicle previously stored in the storage device 9 when data from the EMS 2 of the first vehicle was last received. If any received item of data differs by more than a specified limit from the corresponding data item stored in the storag devic 9 this may be indicative of a forthcoming failure of a vehicle component and th computer 6 will report to a user of the system accordingly, for example

by producing a printed report (in plain english), listing any potential defects, to be issued to the competent maintenance department responsible for the first vehicle and/or to be sent to the owner of the first vehicle.

The newly-received data for the first vehicle is then added to the storage device 9 for subsequent use.

The computer 6 then causes the modem 7 to dial the telephone number of the transmit/receive device of the next subscribing vehicle in the system and receives and processes the operational data from the EMS of that vehicle, and so on for each subscribing vehicle in the system.

If a particular transmit/receive device is temporarily out of communications range the computer 6 will store the number of that device and automatically retry the number later.

It will be appreciated that the EMS units need not be sequentially accessed as described above. For example, different subscribers to the system may wish to choose different levels of service, each such level having a different frequency of interrogation by the computer 6 determined in accordance with the vehicle's age, usage, expected reliability or simply the subscriber's budgetary requirements.

In addition, in case the EMS of a particular vehicle detects the development of a dangerous fault it can cause its associated transmit/receive device to dial the number of the master diagnostics computer 6 at any time to notify personnel at the monitoring station of the fault.

Moreover, the master diagnostics computer can send a diagnostics command signal to a selected vehicle to initiate real time diagnostics in which instantaneous operational data provided by the EMS of the selected vehicle is continuously transmitted thereby to the master diagnostics computer.

As will be apparent from the foregoing, in such a syst m the competent maintenanc d partment for a

subscribing vehicle may be able to pre-empt a catastrophic failure of a vehicl component by contacting the vehicle owner to advise that received operational data is indicative of a forthcoming failure and then making prompt arrangements to replace or repair the affected vehicle component(s) prior to total failure. This will benefit the vehicle owner by reducing the risk of untimely failure of the vehicle and will also benefit the maintenance departments concerned by allowing efficient forward planning of repair work (i.e. manpower scheduling and parts stocking). In the latter regard, a computerised stock control system could be connected to the master diagnostics computer 6 to ensure that parts necessary for repair and/or maintenance of vehicles subscribing to the system are promptly available. If, for example, parts are obtainable from suppliers within a few days, it will in many cases not be necessary for maintenance departments to hold stocks of such parts itself, but merely to order them in response to the data received from the subscribing vehicles, because it will normally be convenient for the vehicle's owner to book the vehicle in for servicing a few days ahead. Reduction of stocks can have worthwhile economic advantages for maintenance departments.

The vehicle monitoring system described above preferably employs a personal communications network (PCN) to provide part of the two-way communications link between the central control unit 5 and each vehicle monitoring equipment 1. However, it will be appreciated that any mobile telephone network capable of supporting data can be used. Furthermore, it is not essential for the operation of a basic system that a two-way communications link be provided. A one-way link, from the EMS unit of a vehicle to the master diagnostics comput r will be sufficient, although in such a case the master diagnostics comput r could not command th EMS unit of a particular vehicle to transmit its collected

operational data.

It will also be understood that, although the system described above makes use of a conventional engine management system (as currently fitted to certain makes of luxury car) any sensing arrangement capable of collecting data from a plurality of sensors disposed within a vehicle can be used. Since instantaneous transmission of operational data is possible the sensing arrangement need not have any data storage capacity.

The transmit/receive devices for use in the system will be essentially similar to normal speech-oriented devices, but with the addition of a data communications port, such as a 25-way D-connector using RS-232 interface hierarchy, for passing data and commands between the device and the engine management system. Commonly, such engine management systems have a data interface employing the above-mentioned 25-way D-connector using RS-232 interface hierarchy.

CLAIMS:

1. Vehicle monitoring equipment, adapted to be carried by a vehicle to be monitored, which equipment comprises assessment means operable to provide data concerning a preselected operational parameter of the vehicle, and data transmission means connected to the said assessment means for receiving such data therefrom and operable to transmit such data over a radio link to data reception means remote from the said vehicle.

2. A vehicle monitoring system including vehicle monitoring equipment as claimed in claim 1 and a monitoring station comprising a central control unit having data processing means, connected with the said data reception means, for receiving therefrom such data transmitted by the said vehicle monitoring equipment and operable on the basis of the received data to provide to a user of the system an indication of the functioning of the vehicle.

3. A vehicle monitoring system as claimed in claim 2, wherein the said central control unit further comprises data storage means connected with the said data processing means for storing a data item based upon data received from the said vehicle monitoring equipment on one occasion, the said data processing means being operable on a subsequent occasion to recall that stored data item from the storage means and to compare that item with newly-received data from the said vehicle monitoring equipment, whereby, on the basis of the results of such comparison, malfunction of the vehicle can be detected.

4. A vehicle monitoring system as claimed in claim 2 or 3, wherein the said data transmission means include a transmit/receive device of a mobile telephone network, which network provides the said data reception means.

5. A vehicle monitoring system as claimed in claim 4, wherein the said central control unit is connected by way of a modem to the public switched telephone network, the said mobile t lephone network being connected to th said

public switched telephone network.

6. A vehicle monitoring system as claimed in claim 4 or 5, wherein the said mobile telephone network is a personal communications network.

7. A vehicle monitoring system as claimed in any one of claims 2 to 6, wherein the said central control unit is operable to transmit an interrogation signal to the said vehicle monitoring equipment so as to cause that equipment to transmit its data to the central control unit.

8. A vehicle monitoring system as claimed in claim 7, wherein the said vehicle monitoring equipment is one of a plurality of such equipments carried by different respective vehicles to be monitored, and the said central control unit is operable to transmit such an interrogation signal to each vehicle monitoring equipment of the said plurality in a predetermined sequence.

9. A vehicle monitoring system as claimed in any one of claims 2 to 8, wherein the said data processing means is connected to a stock control system for providing thereto, on the basis of such data received from the vehicle monitoring equipment, information identifying parts necessary for repair/maintenance of the vehicle concerned.

10. A vehicle monitoring system as claimed in any preceding claim, wherein the said assessment means include a computerised engine management system.

11. Vehicle monitoring equipment substantially as hereinbefore described with reference to the accompanying drawing.

12. A vehicle monitoring system substantially as hereinbefore described with reference to the accompanying drawing.

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Patents Act 1977
Examiner's report to the Comptroller under Section 17 (The Search Report)

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Relevant Technical fields

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(ii) Int CL (Edition 5) G01M 15/00;G015 13/74; H04B 7/00

Search Examiner

N W HALL

Databases (see over)

(i) UK Patent Office

(ii) WPI ON-LINE

Date of Search

15 MAY 1992

Documents considered relevant following a search in respect of claims 1-12

Category (see over)	Identity of document and relevant passages	Relevant to claim(s)
X,Y	GB 2224418 A (RIGBY) whole document	1
X,Y	GB 2155720 A (STC) whole document	1
Y	US 4868859 (SHEFFER) see particularly column 11 lines 12-20	1

SF2(p)

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Category	Identity of document and relevant passages	Relevant to claim(s)

Categories of documents

X: Document indicating lack of novelty or of inventive step.

Y: Document indicating lack of inventive step if combined with one or more other documents of the same category.

A: Document indicating technological background and/or state of the art.

P: Document published on or after the declared priority date but before the filing date of the present application.

E: Patent document published on or after, but with priority date earlier than, the filing date of the present application.

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